

Improved OMI NO₂ Standard Product: SPV2.1: algorithm, evaluation, and results

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Evaluation:

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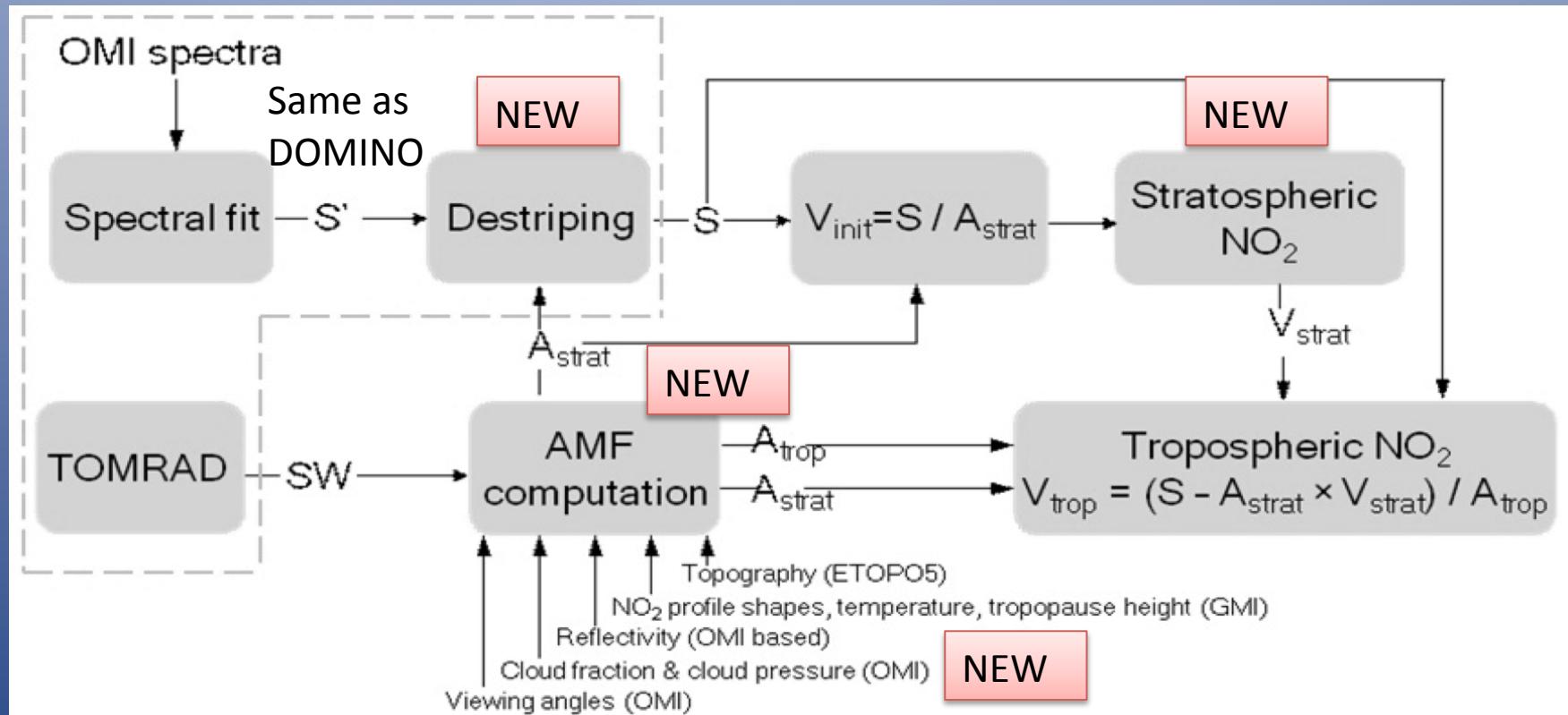
K. Pickering, L. Yurganov

J. Herman, E. Spinei,

T. Canty, R. Salawitch, R. Dickerson (AOSC/UMCP)

C. McLinden (EC)

OMNO2 SPV2.1 Algorithm

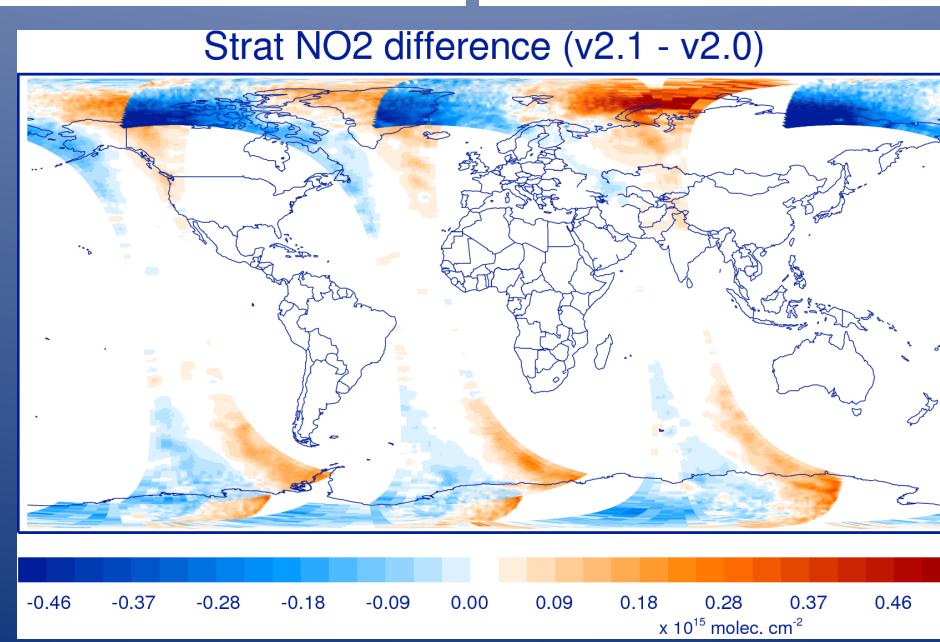
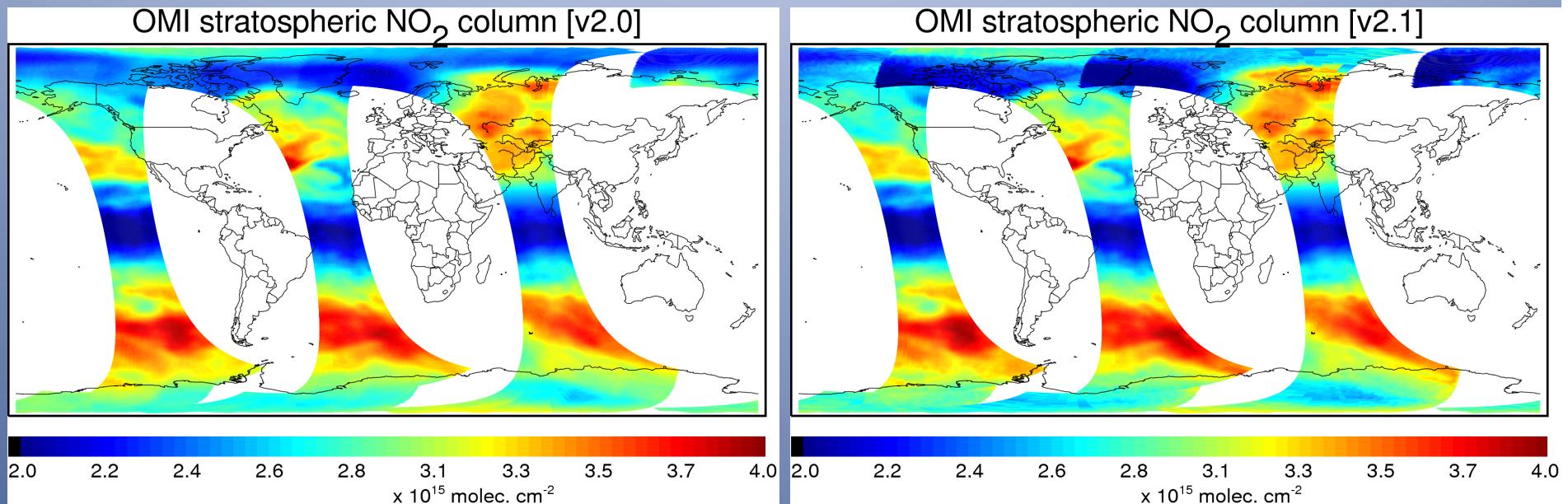


Bucsela et al., to be submitted AMT 2012

OMI NO₂ Standard Product (SP) Updates

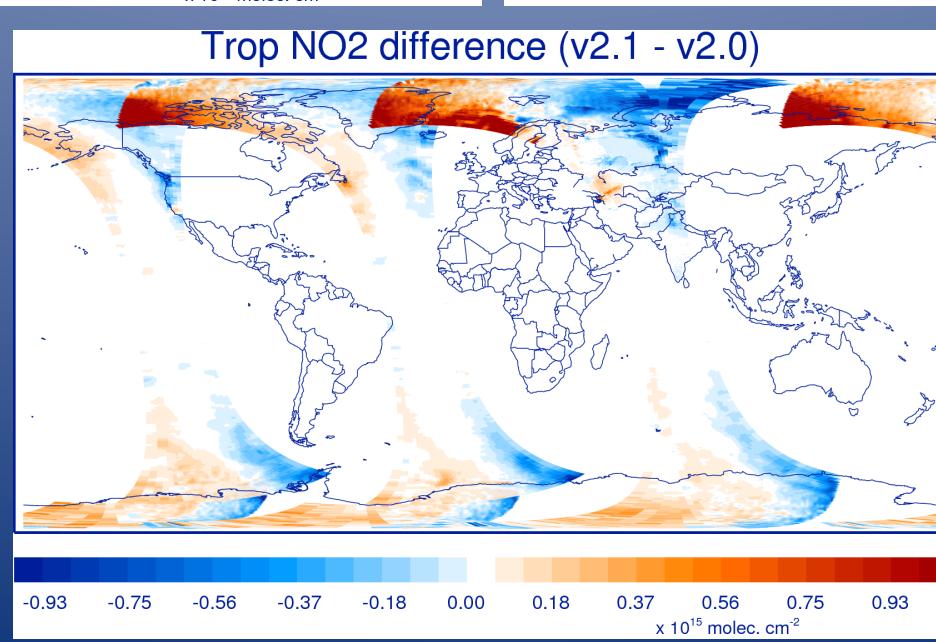
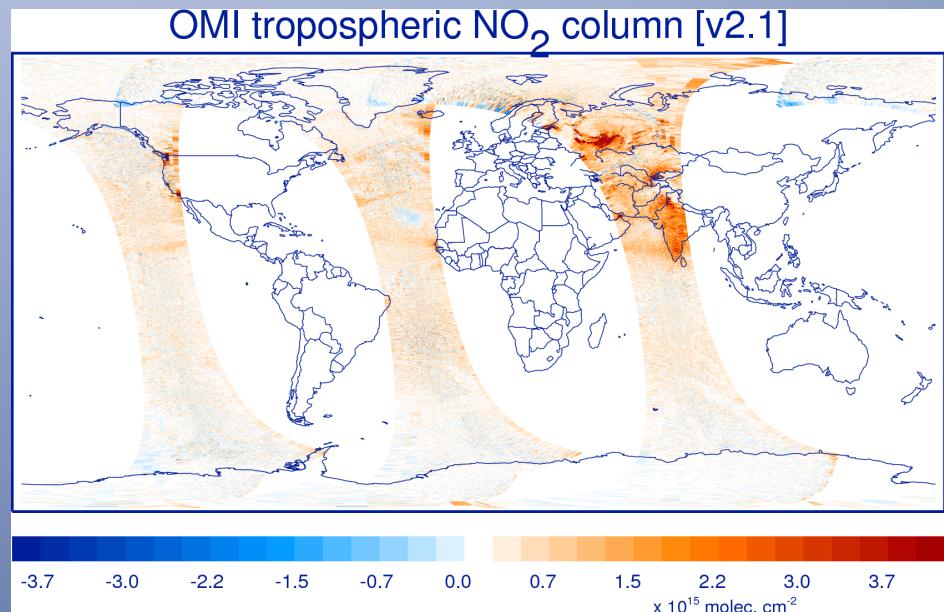
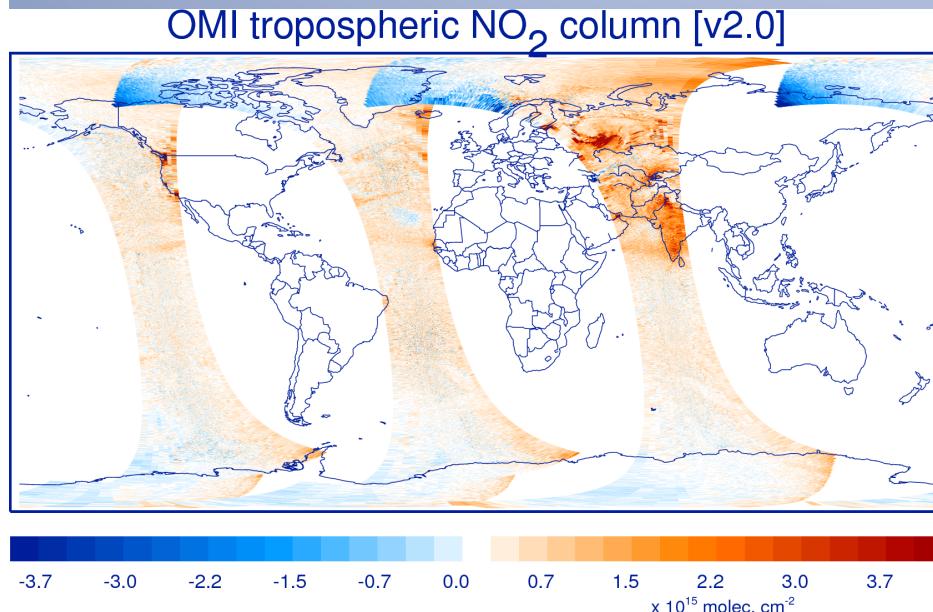
- Version 2.0 released in December 2011
 - New Stratosphere Troposphere Separation scheme
 - Improved de-striping algorithm
 - Incorporation of GEOS-5-based GMI NO₂ monthly climatology, OMI surface albedo
 - Scattering weights added for comparisons with models and vertically resolved measurements
- July 2012: New v2.1 with significant improvements
 - Refined stratospheric weighting scheme
 - Simplified data fields: S, Vstrat, Vtrop and Vtotal
 - Pixel corners included for averaging
 - Better row anomaly filtering
- May 2012: New NO₂ lightning product for DC3 campaign
(Ken Pickering: Wednesday 9:30am)

(1) Changes in stratospheric NO₂ due to weighting scheme (local observations gets more weight)



2005-03-21

(1) Changes in tropospheric NO₂ due to weighting scheme (local observations gets more weight)



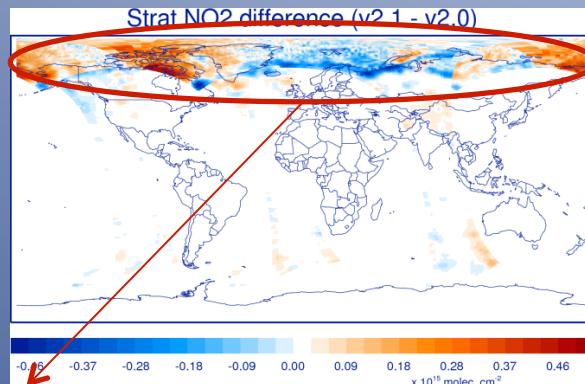
2005-03-21

(2) Changes in stratospheric NO₂ due to complete exclusion of RA observations in de-striping

V2.0 → Partial exclusion of RA observations (error)

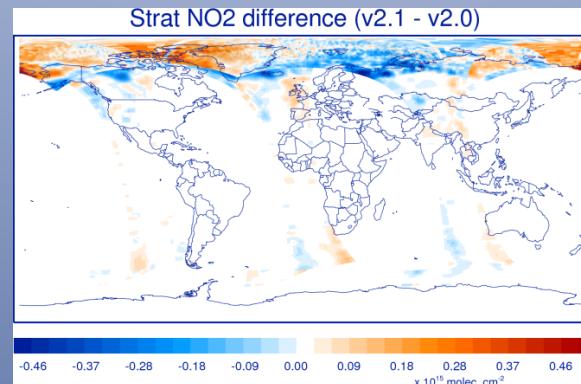
V2.1 → Complete exclusion of RA observations

July 15, 2006

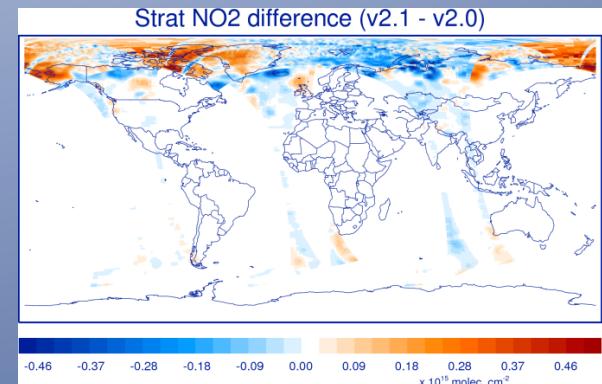


Effect of weighting scheme

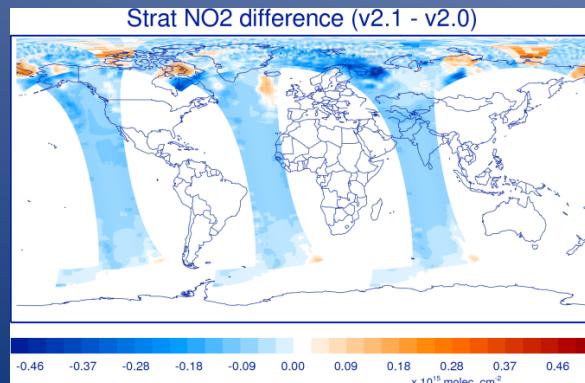
July 15, 2007



July 15, 2008



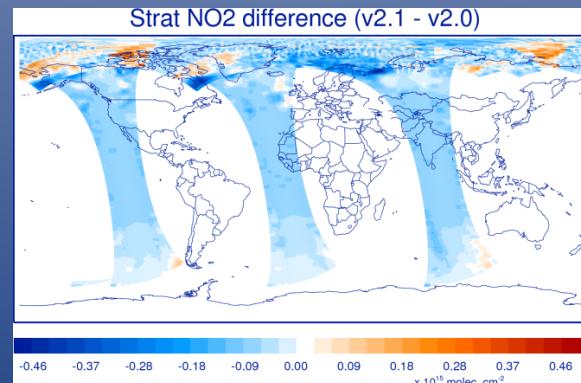
July 15, 2009



Cross-track positions 27-44,
53-54 affected by RA

Cross-track positions 53-54
affected by RA

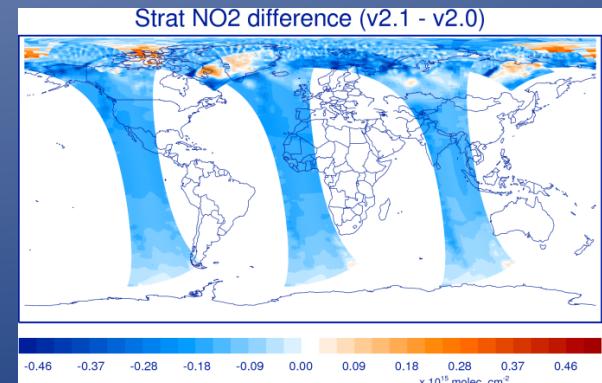
July 15, 2010



Cross-track positions 27-44,
53-54 affected by RA

Cross-track positions 37-42, 53-54
affected by RA

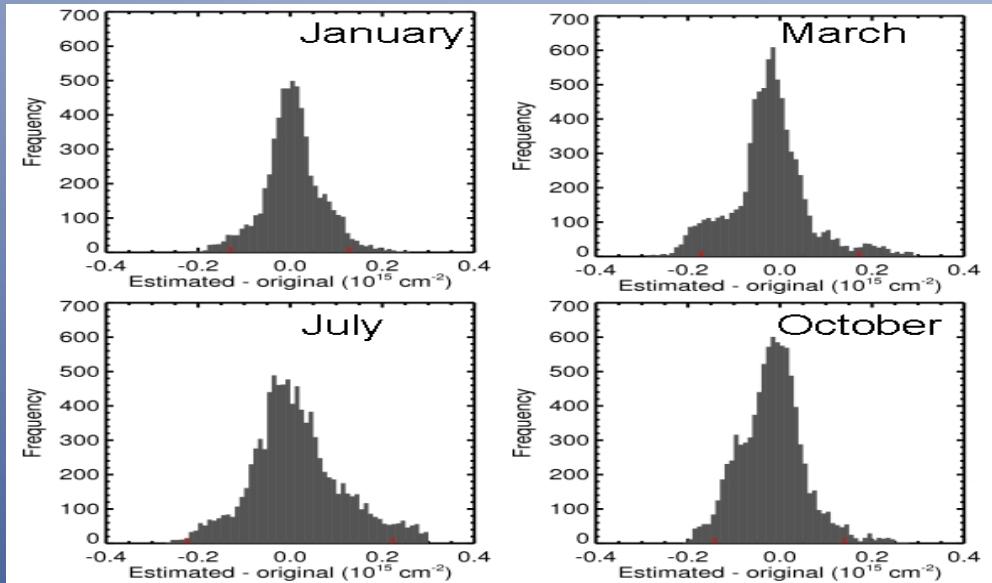
July 15, 2011



Cross-track positions 25-54 (?)
affected by RA

OMNO2 error estimates

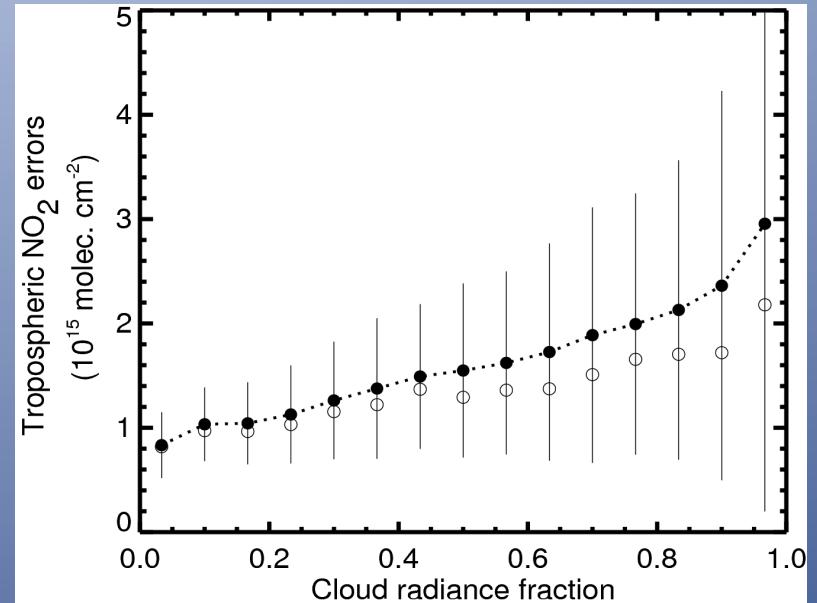
Stratospheric Errors



Histograms of difference between estimated and original stratospheric NO₂ columns over polluted areas for January, March, July, and October.

2-sigma level difference:
~ 0.2 10^{15} molec/cm 2

Tropospheric Errors



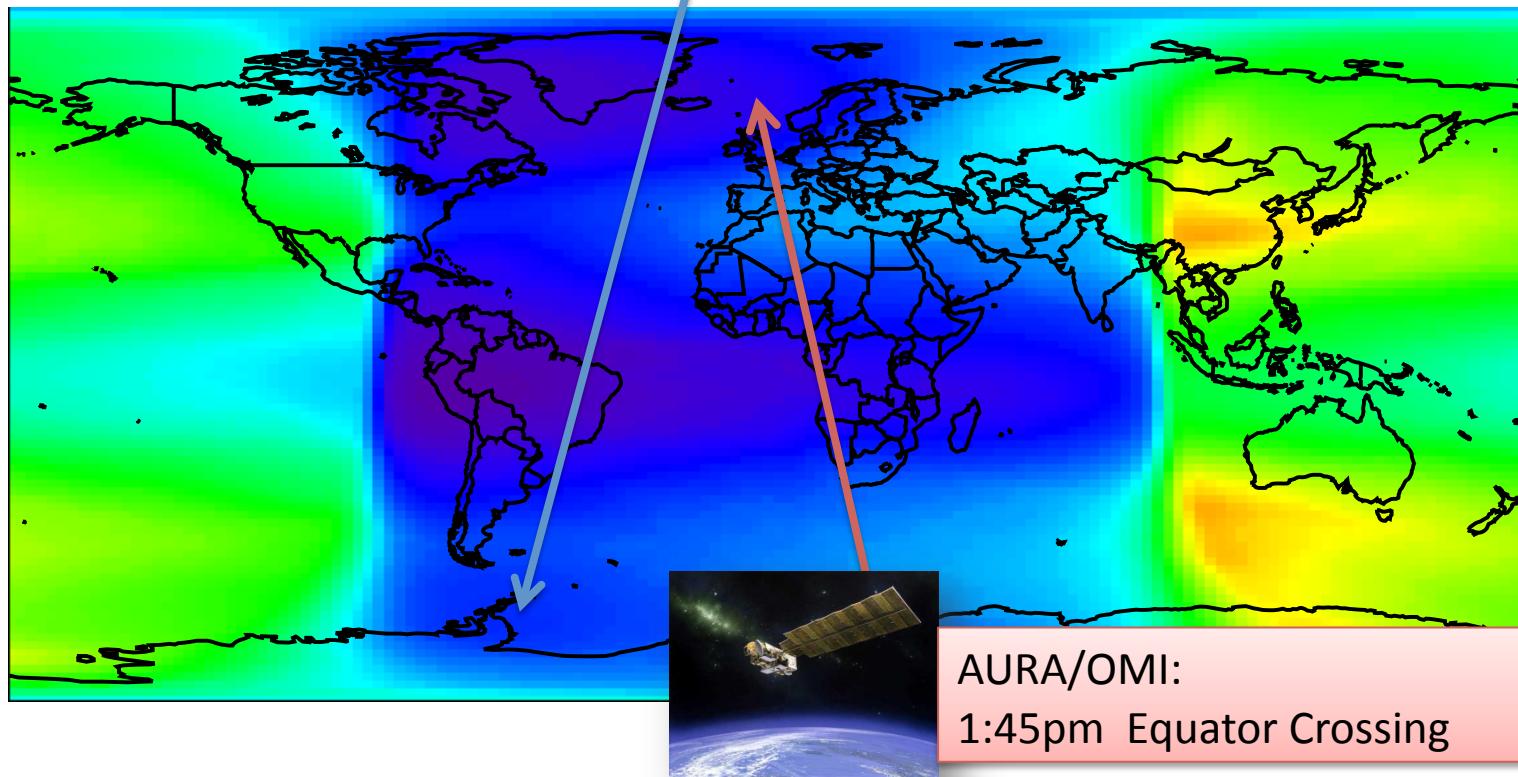
Variation in errors in NO₂ tropospheric vertical column retrievals from OMI for one day of data over the United States (2005-03-21), shown as a function of cloud radiance fraction. Filled circles are mean errors with bars showing standard deviation. Open circles are medians.
[Bucsela et al 2012]

Stratospheric Column NO₂ comparisons

SCIAMACHY/ENVISAT
10am Equator Crossing



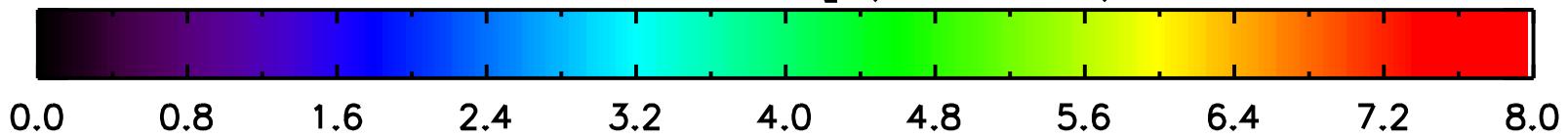
MERRA (Mar 2005)

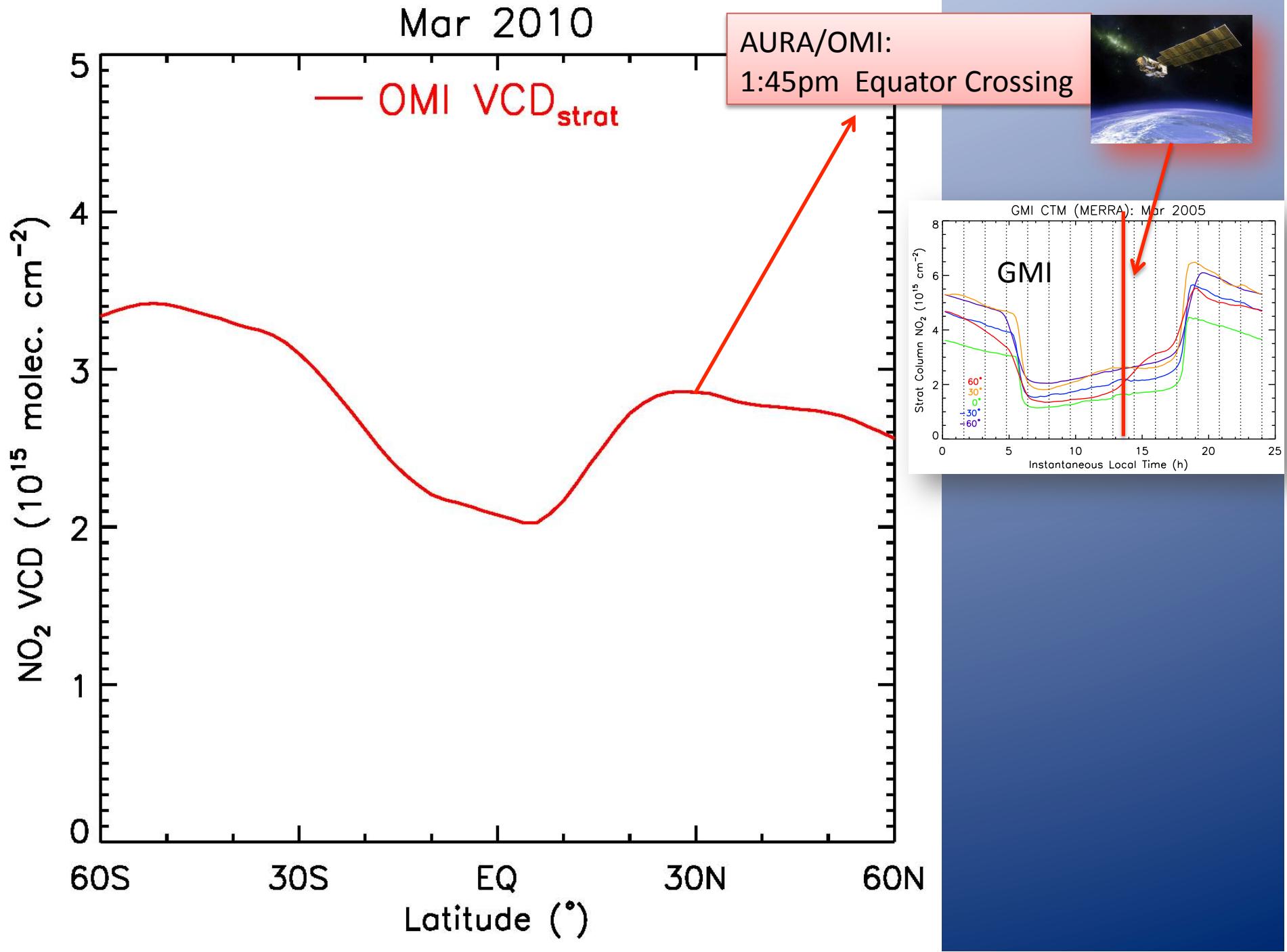


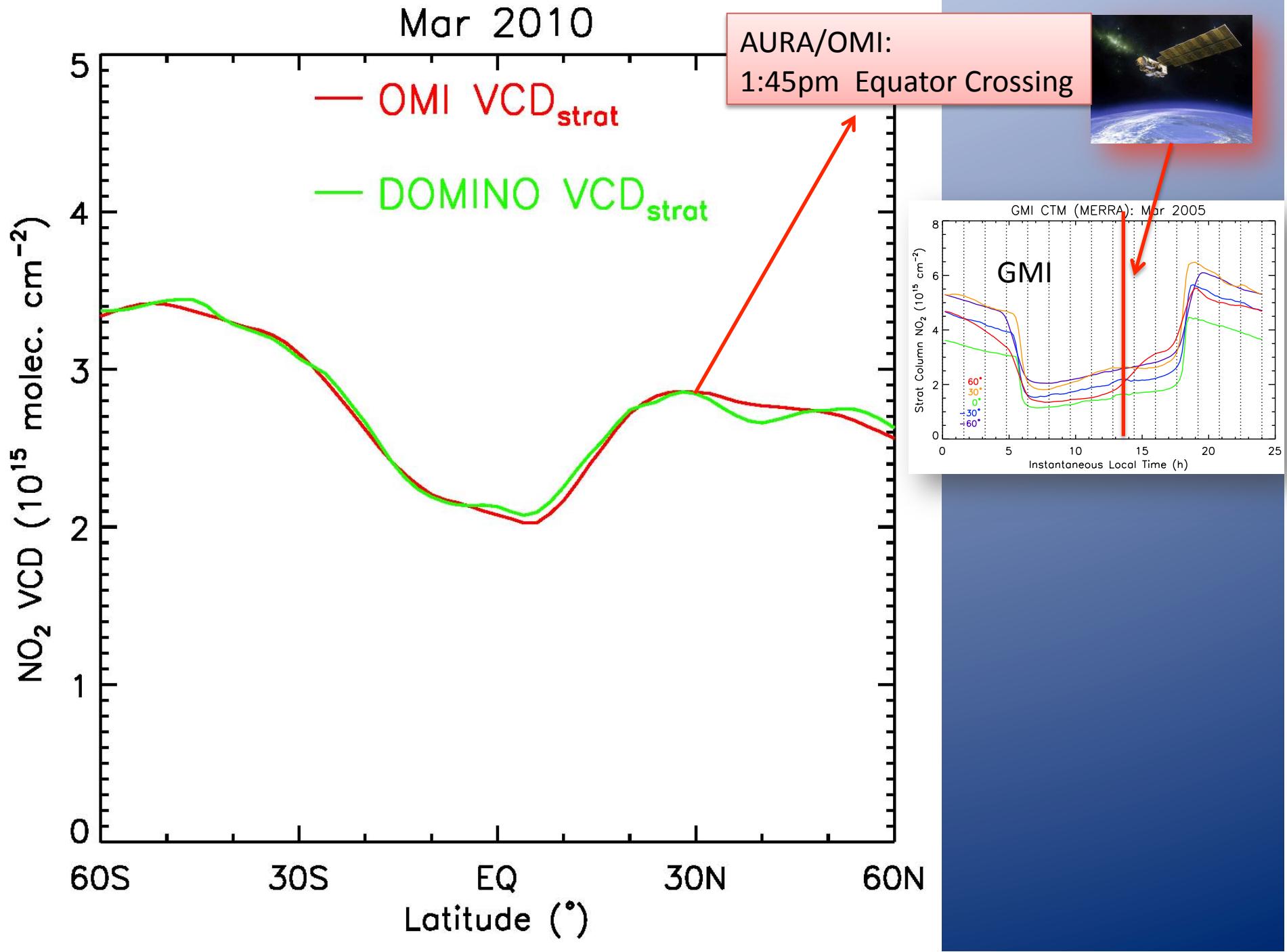
AURA/OMI:
1:45pm Equator Crossing

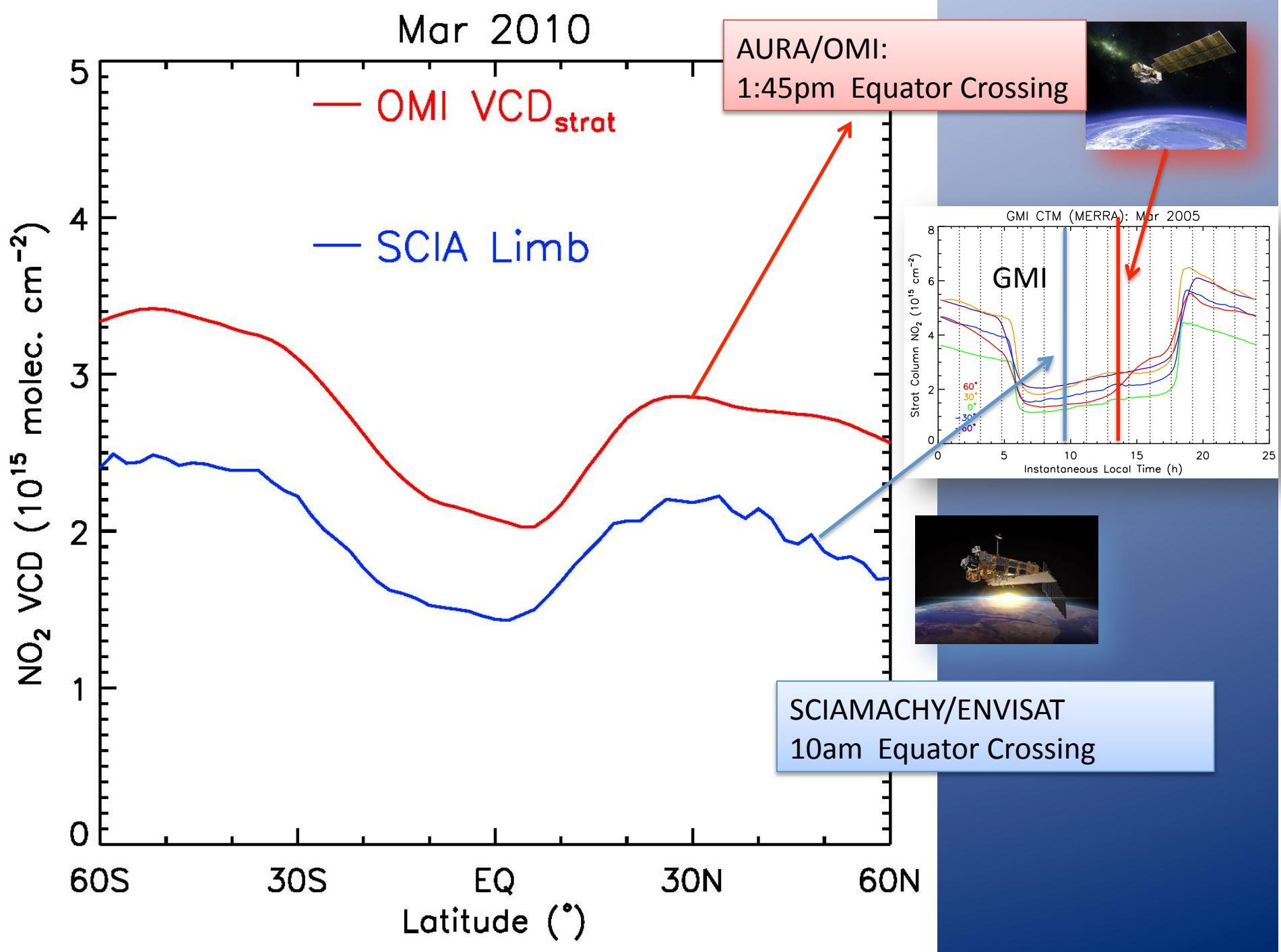


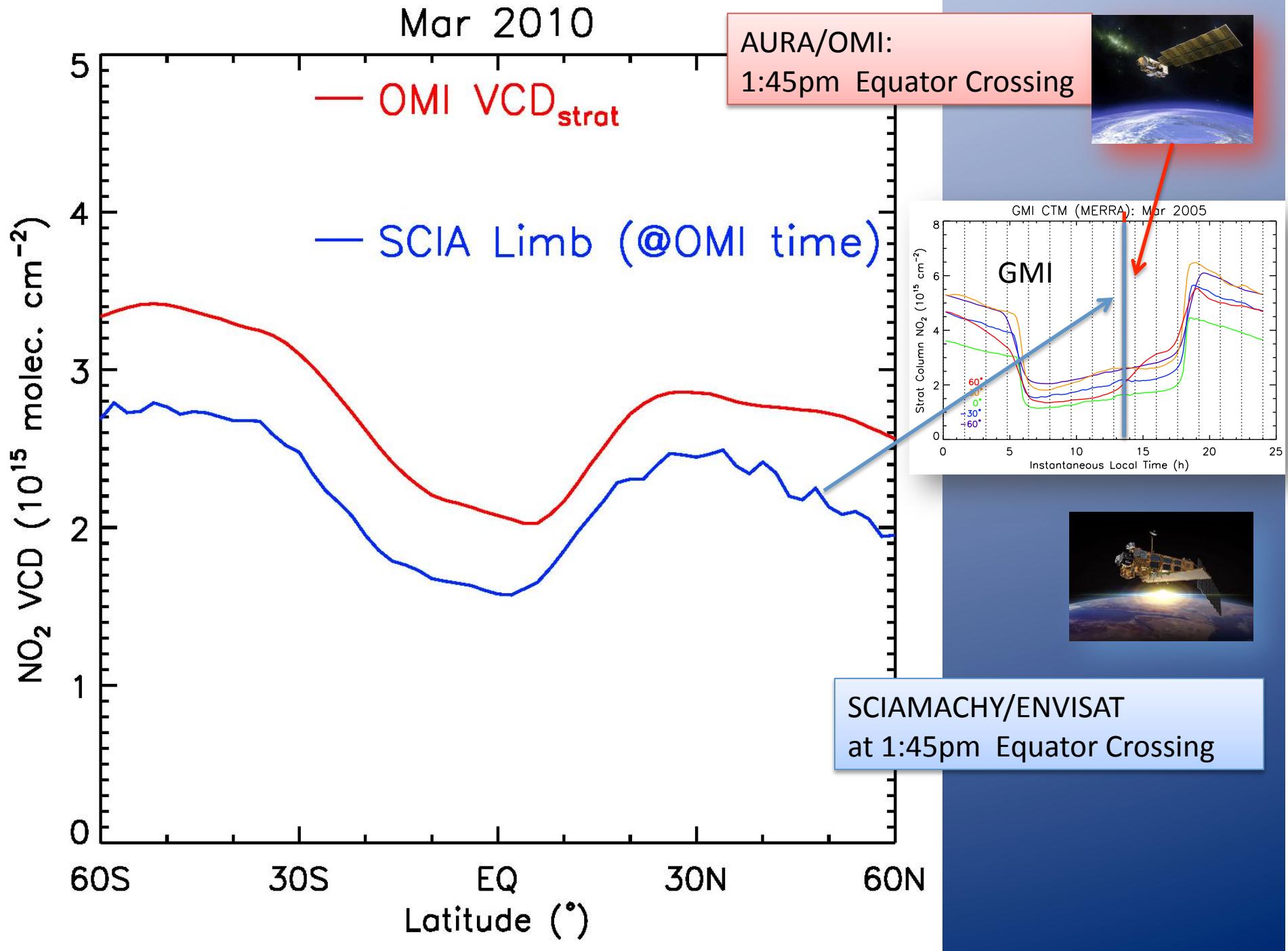
Strat Column NO₂ (10^{15} cm^{-2})

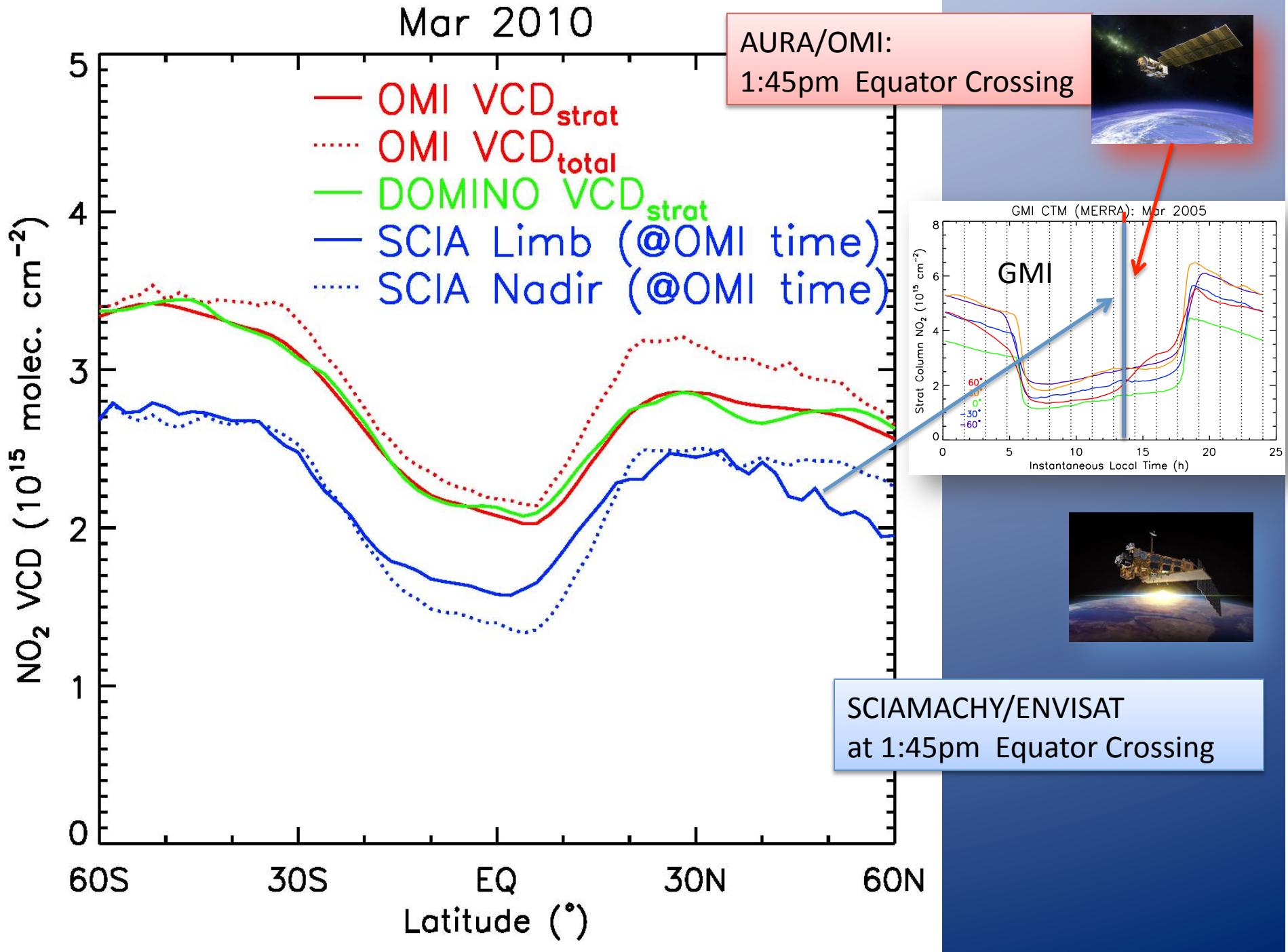








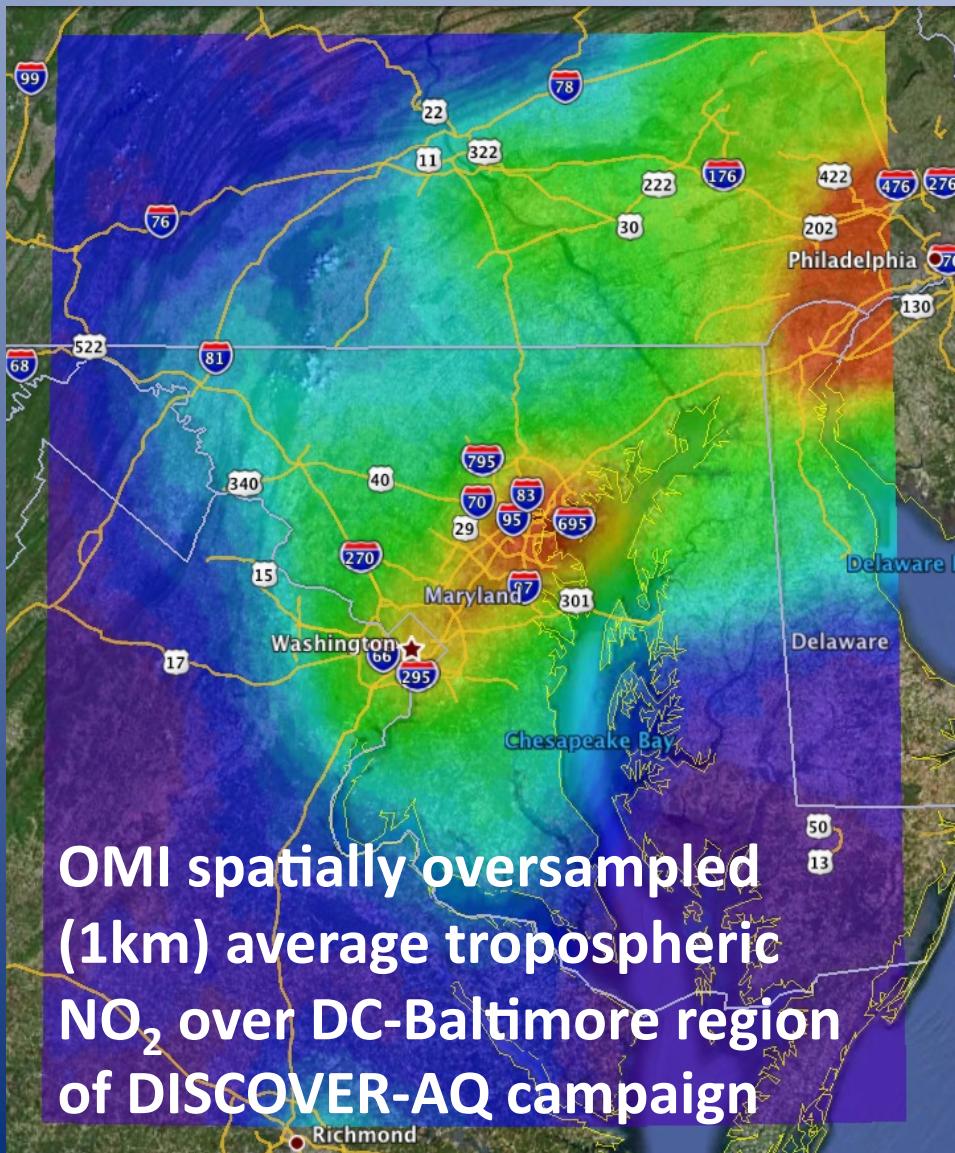




Need to investigate differences in satellite Stratospheric Column NO₂

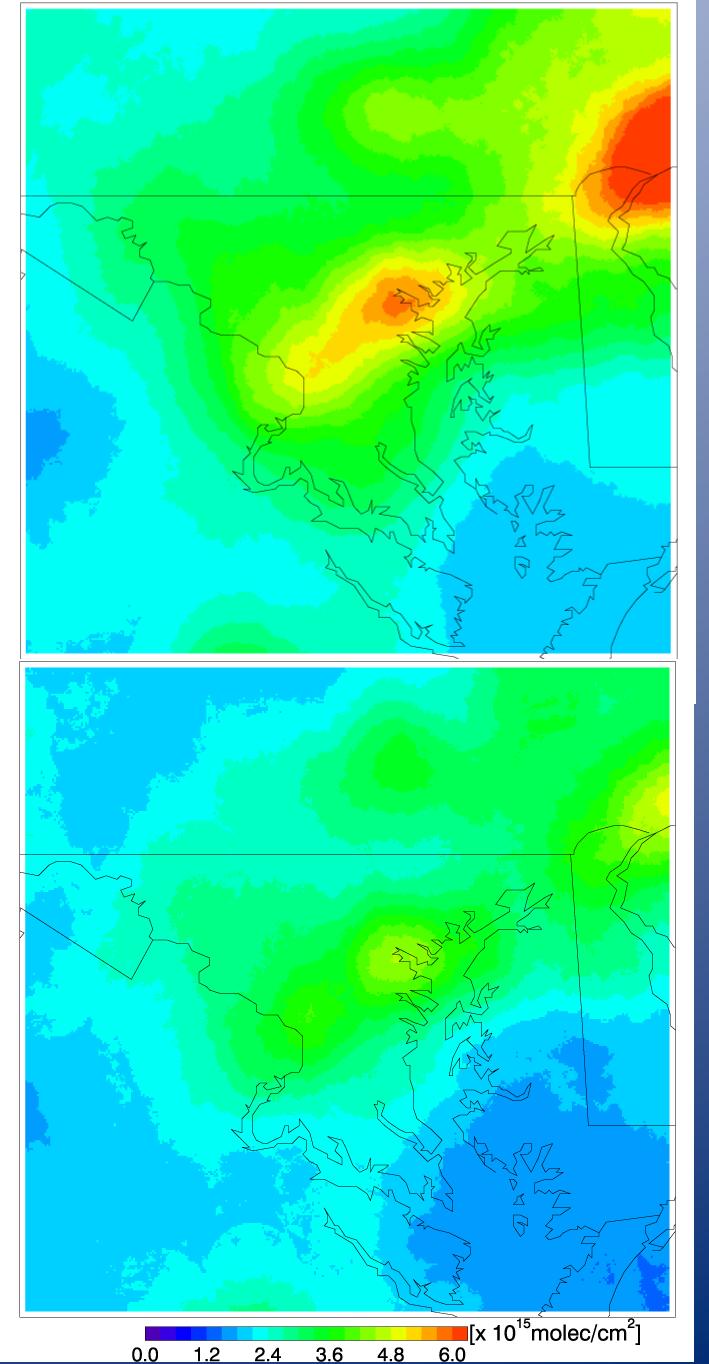
- Compare model diurnal NO₂ cycle
 - GMI vs TM4 vs TM5
- Compare spectral fitting algorithms: SCD ?
 - Apply OMI fitting to SCIA radiances
 - Change fitting windows, fitting parameters
- Check radiative transfer for AMFs calculations

Tropospheric NO₂ field in urban areas is highly inhomogeneous

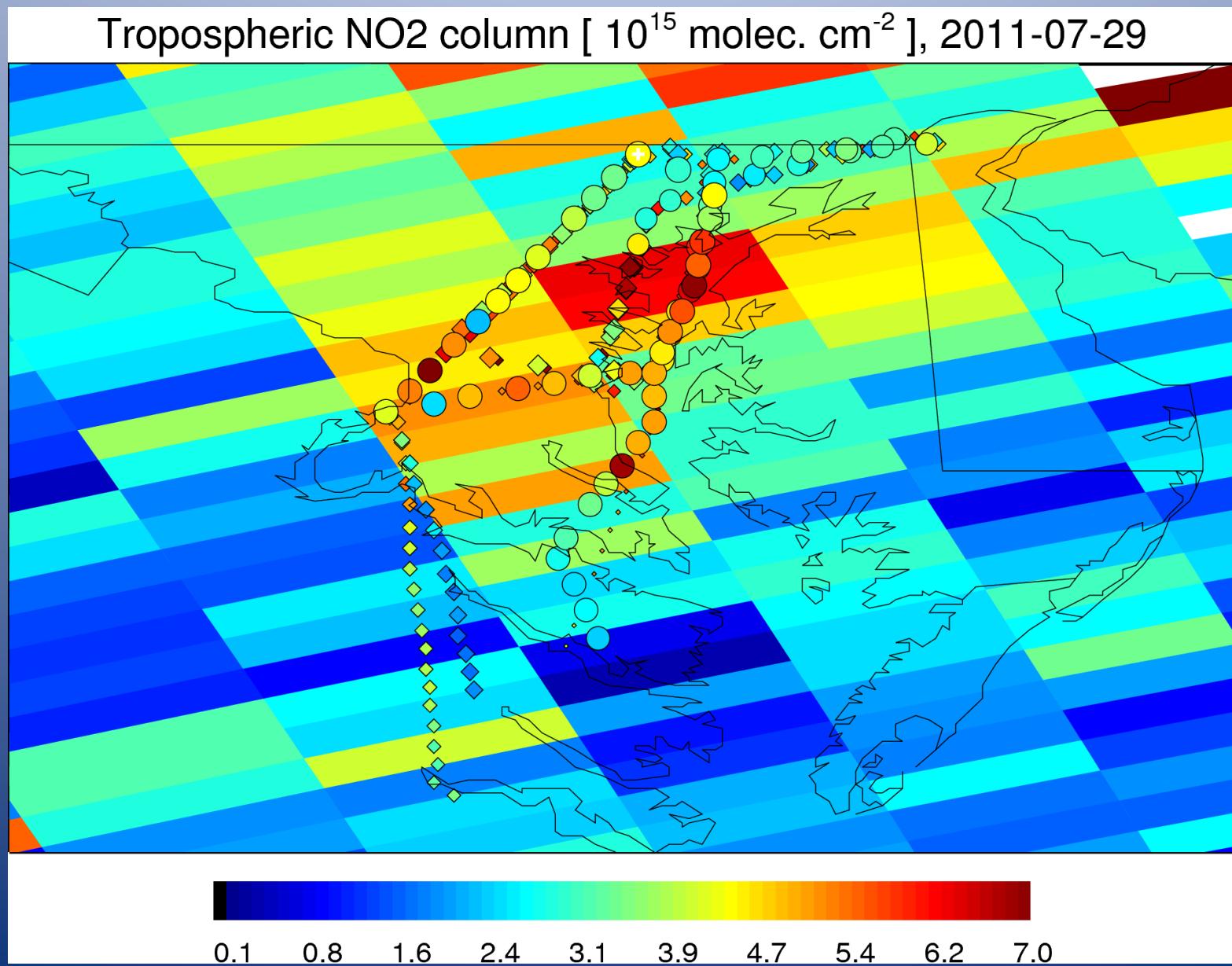


May-Aug 2005-2007

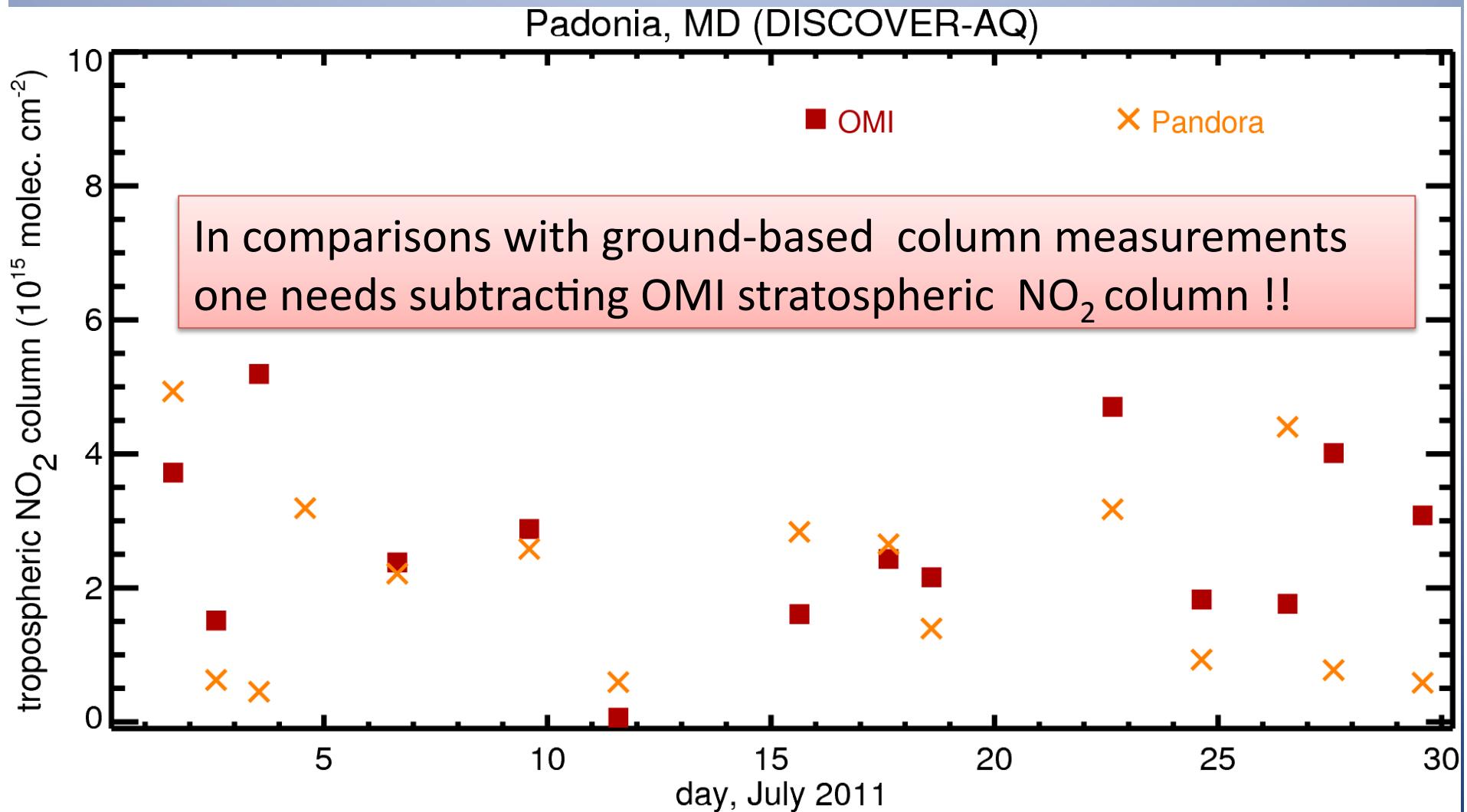
May-Aug 2009-2011



Comparisons with aircraft ACAM measurements



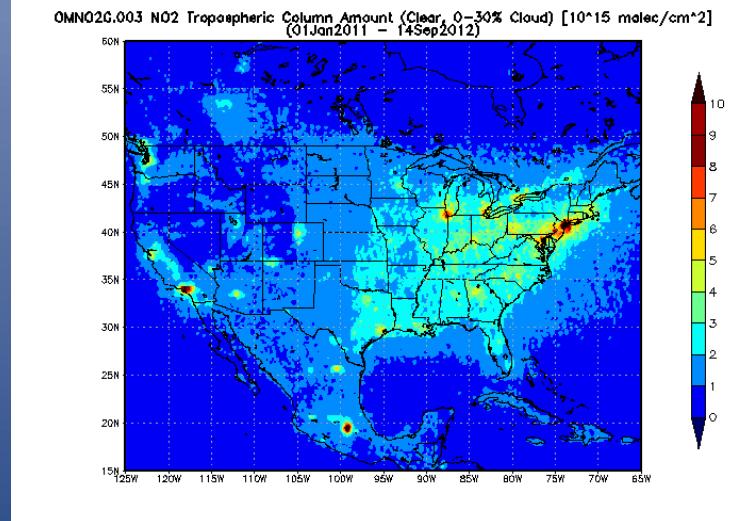
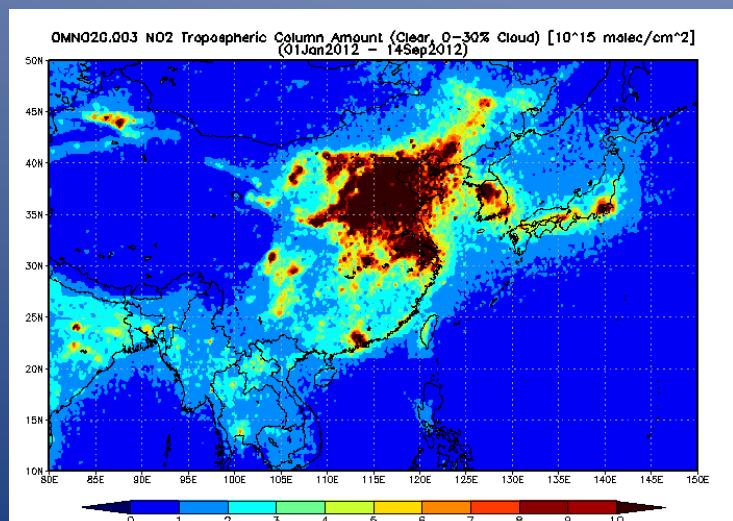
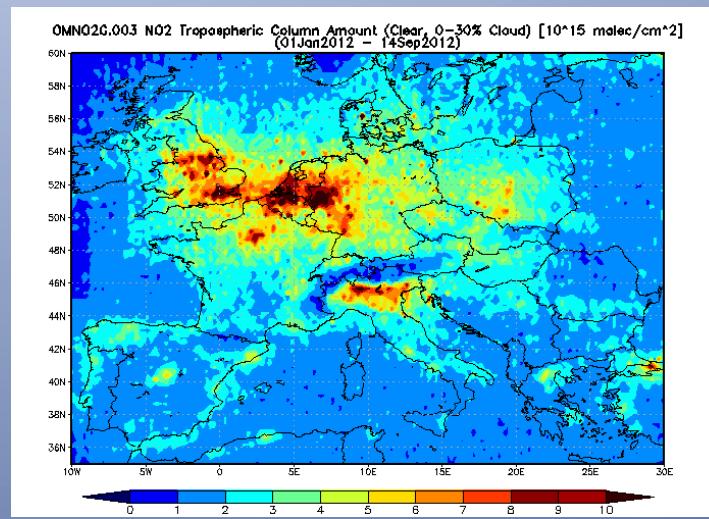
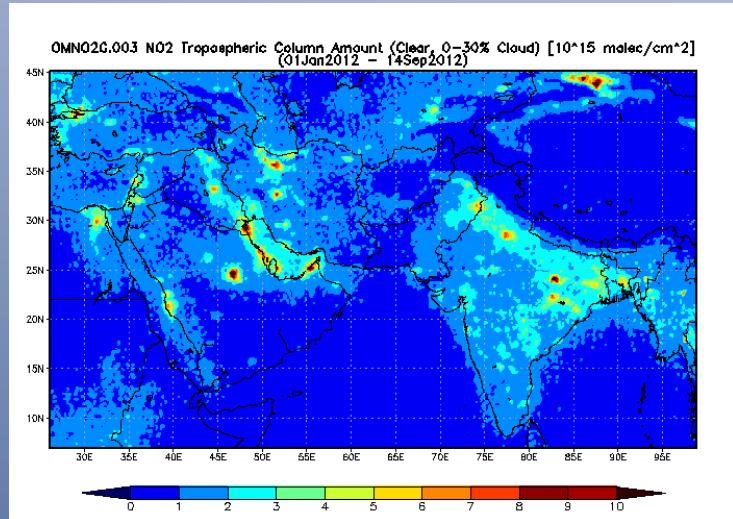
Comparisons with ground-based PANDORA measurements



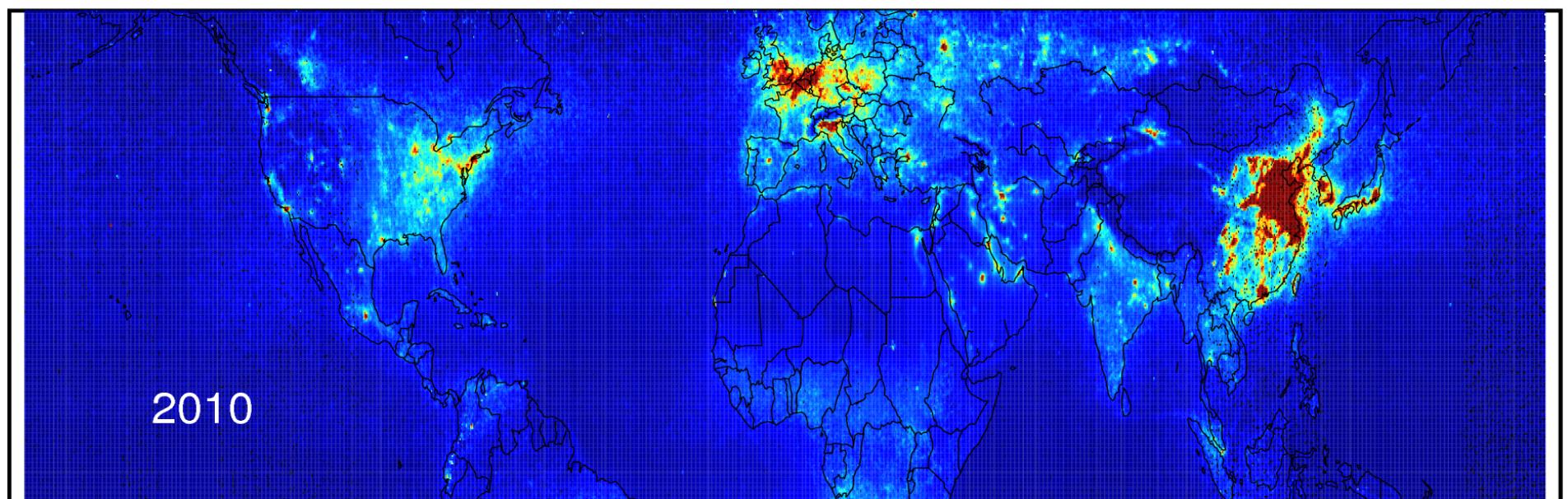
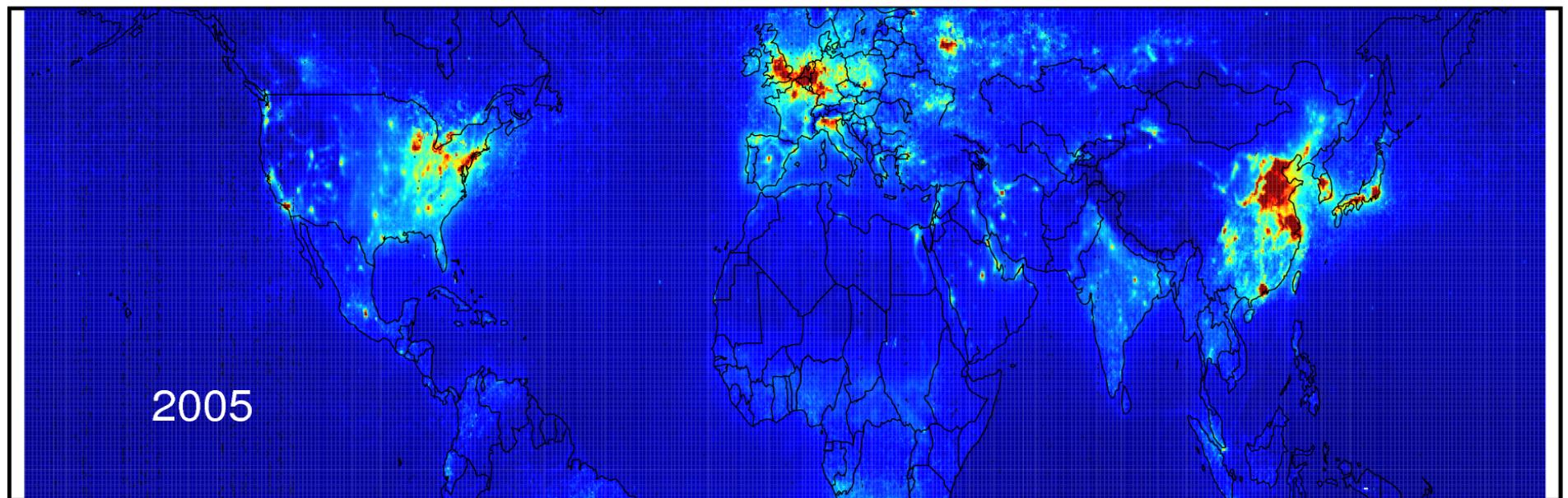
See Poster: Comparison of Pandora Ground-Based Measurements of Total Column NO_2 with OMI Satellite Measurements
(Jay Herman (UMBC-NASA/GSFC), A. Cede, N. Abuhassan, and M. Tzortziou)

Re –processed OMI NO₂ data archived at NASA/GSFC/DISC:

http://disc.sci.gsfc.nasa.gov/Aura/data-holdings/OMI/omno2_v003.shtml



OMI NO₂ images produced using NASA/DISC GIOVANNI web interface



Tropospheric NO₂ (10^{15} molec. cm⁻²)

